Specifications

Gateway
- Fault tolerance on gateway PRI and IP interfaces
- Supports hot-standby mode
- Recovery procedures for system components including loss of IP connectivity
- Scalability and performance
- Full load capabilities of up to 360 simultaneous calls per shelf* (30 ports x 12 HDMs)
- Call setup delay less than 1 second
- Voice transfer delay less than 100 ms

Hardware/Software Requirements
Hardware requirements are static and cannot be altered. The edge server card set must be used for the media gateway. Minimum software requirements must be met, but optional software can be added as needed.

DSP Cards
Hardware: Each card supports one T1/E1 trunk

Each shelf supports up to 12 T1/E1 trunks for connectivity

to the PSTN

Edge Server Cards
Hardware: Each shelf supports multiple cards
- 450MHz processor
- 256 MB RAM
- PCI dual 10/100 Ethernet NIC

Network Management Card (NMC)
- Hardware: one per shelf
- Unified management interface for all gateway functions
- SNMP access and security

Dual Power Supplies
- Provide 130 A including both DC and/or AC power to the unit

DSP Features
- G.711, G.723.1, G.729a and b
- H.245 in-band DTMF support for G.711
- RFC 2833 out-of-band DTMF support for G.723.1 and G.729 a and b
- G.168-compliant echo cancellation
- Silence suppression via voice activity detection and comfort noise generation (VAD/CNG)
- Multiple audio frames per RTP packet
- Configurable packet payload size

PSTN Signaling/Interfaces
- Supports 105 and 108 test function for on-demand loopback testing
- SS7, T1/E1-PRI, and E1-R2

IP Signaling
- H.323 v2 with fast start
- H.225 RAS, and H.245 media gateway controller routed model
- H.450 business services
- SIP RFC 2543 compliant

IP Fax
- Real-time fax-to-fax pass through via G.711 or T.38 for G.723.1 and G.729 a and b
- Voice/fax /data type detection

H.323 Support
- All mandatory features of H.323-v2.
- H.323-v2 optional features—globally unique identifier for each call, fast start
- H.225/Q.931 signaling-compliant gateway-to-gateway communication
- Interzone communications

SIP Support
Complies with RFC 2543

CommWorks
a 3Com company

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To learn more about 3Com solutions, visit www.3com.com. 3Com Corporation is publicly traded on Nasdaq under the symbol COMS.

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EXHIBIT 6

CommWorks
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CommWorks IP Telephony

Overview Guide
Release 2.3
Part Number 10044866

CONTENTS

LIST OF TABLES

LIST OF FIGURES

About This Guide

About This Guide contains an overview of this guide, describes where to find specific information, lists conventions and related documentation, and explains how to contact CommWorks.

This guide provides an overview of the CommWorks IP Telephony platform and explains how to plan to its installation.

The Overview part of this guide is intended for all telecommunications personnel, including system engineers and planners, developers, operational personnel, testers, and field support. The Planning and Technical Specifications parts are aimed primarily at system engineers and planners, and operations personnel.

Release notes are issued with some products—visit our website at ***http://totalservice@commworks.com****. If the information in the release notes differs from the information in this guide, follow the instructions in the release notes.*

Finding Information

The following table lists where to find information in this guide.

Table 1 Finding Information

If you are looking for	Go to
Overview of system components and how they interact	Chapter 1
Call flow diagrams	Chapter 2
IP addressing guidelines	Chapter 3
Technical specifications	Chapter 4
Glossary	Appendix A

Conventions

These tables list conventions used throughout this guide.

Table 2 Notice Conventions

Icon	Notice Type	Description
	Information note	Information that contains important features or instructions.
	Caution	Information to alert you to potential damage to a program, system, or device.
	Warning	Information to alert you to potential personal injury or fatality. May also alert you to potential electrical hazard.
	ESD	Information to alert you to take proper grounding precautions before handling a product.

Table 3 Text Conventions

Convention	Description
Text represented as a `screen display`	`This typeface` represents displays that appear on your terminal screen, for example: `Netlogin:`
Text represented as **`commands`**	**`This typeface`** represents commands that you enter for example: **`setenv TCMHOME directory`** *This guide always gives the full form of a command in uppercase and lowercase letters. However, you can abbreviate commands by entering only the uppercase letters and the appropriate value. Commands are not case-sensitive.*
Text represented as **menu** or **sub-menu names**.	**This typeface** represents all menu and sub-menu names within procedures, for example: On the **File** menu, click **New**.

Related Documentation

The following documents contain information about the components of the CommWorks IP Telephony Platform:

- CommWorks IP Telephony System Software Installation Guide
- CommWorks IP Telephony Overview Guide
- CommWorks IP Telephony Hardware Installation Guide
- Total Control 1000 Media Gateway Guide
- CommWorks 4200 Gatekeeper Guide
- CommWorks 4220 SIP Proxy Server Guide
- CommWorks 7220 Accounting Server Guide
- CommWorks 7230 Billing Support Server Guide
- CommWorks 7210 Directory Mapping Server and CommWorks 7240 Web Provisioning Server Guide

- CommWorks 5210 IP Telephony Manager Guide (1000 Platform)
- CommWorks IP Telephony Parameter (MIB) Reference Guide
- CommWorks IP Telephony Trap (Alarm) Reference Guide
- CommWorks 4007 SS7 Signaling Gateway Operation and Maintenance Guide

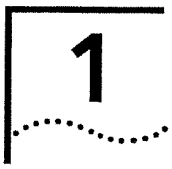
Contacting CommWorks

This section describes how to contact CommWorks Technical Support.

Before contacting CommWorks Technical Support, have this information available:

- Contract number
- Problem description
  - Symptoms
  - Known causes
- CommWorks products
  - Software and hardware versions
  - Serial numbers
- Trouble clearing attempts

For information Customer Service, including technical support telephone numbers, training, code releases and updates, contracts, and documentation, visit our website at ***http://totalservice@commworks.com****.*



SYSTEM OVERVIEW

This chapter contains overview information for the CommWorks IP Telephony Platform.

This chapter contains the following topics:

Unless otherwise specified, this document uses the generic term edge server to refer to either the EdgeServer Pro card or the edge server card.

CommWorks IP Telephony Platform

The CommWorks IP Telephony Platform is a system of hardware and software components that route telephone calls over an IP-based network. Routing calls over IP provides an alternative infrastructure to that of traditional long-distance service. It is cheaper and more efficient and is a step toward creating a single network for carrying voice, modem, and fax traffic.

For network ingress, a Telco switch at a point-of-presence connects to a CommWorks IP Telephony Media Gateway via one of the following:

- T1 Primary Rate Interface (PRI)
- T1 Inter-machine Trunk (IMT) when used with SS7 signalling
- E1 Primary Rate Interface (PRI)
- E1/R2 Multifrequency Compelled (MFC) signalling
- E1 Inter-machine Trunk (IMT) when used with SS7 signalling

When the Media Gateway is enabled for SS7 signalling, the Media Gateway uses E1 IMT, or T1 IMT, connections to the Telco switch and signalling is done over an IP network to an SS7 signalling Gateway.

Voice, modem, facsimile, and call-control traffic flows over an IP network to an egress CommWorks IP Telephony Media Gateway. The egress Gateway connects to a Telco switch at the central office of the local exchange carrier (LEC).

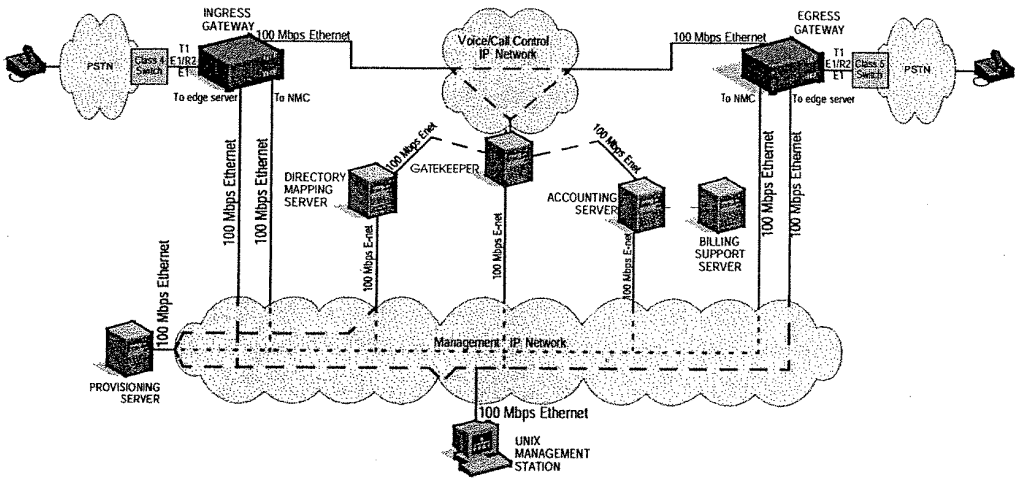
The CommWorks IP Telephony network is packet-switched and no fixed connections are made between points; analog voice is converted to digital data and travels across the network in small packets that are reassembled by the destination Media Gateway. The CommWorks platform is more efficient than traditional systems because a circuit is not held open for the duration of the call and packets flow only when there is voice information to transmit.

The diagram on the next page shows the components of the CommWorks IP Telephony Platform and how they interact.

Components include:

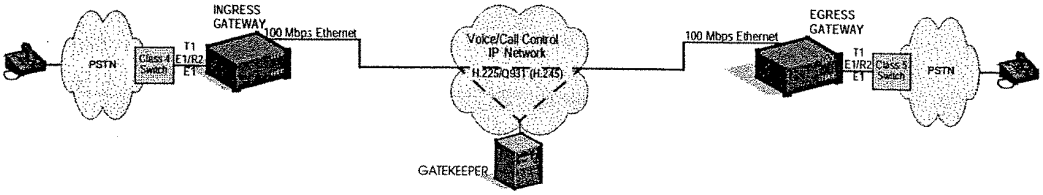
- Media Gateway
- Proxy Server (SIP)
- Gatekeeper (H.323 applications)
- Back-end Servers: Directory, Billing Support, and Accounting
- Provisioning Server (the Web-based interface to the Back-end Servers)

Figure 1 CommWorks IP Telephony Platform



Basic Traffic Flow When a call is connected, voice, modem, or fax traffic flows between the ingress and egress Gateways.

Figure 2 Traffic Flow During Call Connection



Audio traffic generated at the ingress side flows from a Telco switch over an E1 line to a HiPer Digital Signal Processor (DSP) card in the CommWorks IP Telephony Media Gateway. The HiPer DSP codes the audio in G.711 or G.723.1 format and then sends the audio over a packet bus in the Media Gateway to an CommWorks edge server voice card. The edge server card sends the audio through its 100-Mbps ethernet interface over an IP network to an egress Gateway.

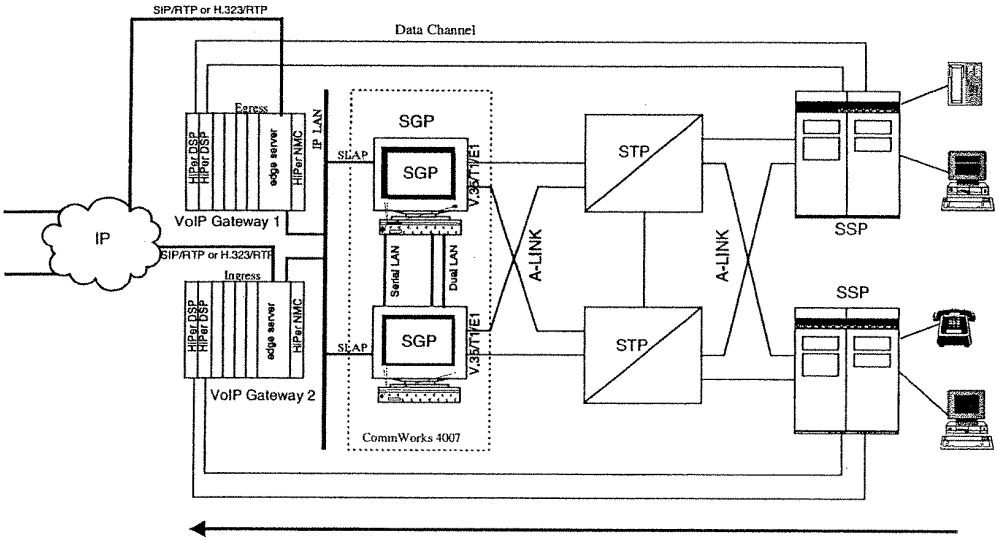
Between the Media Gateways, data flows according to the Real Time Protocol (RTP), over the User Datagram Protocol (UDP) over IP.

At the egress Gateway, the edge server card receives the audio through its 100-Mbps Ethernet port and sends it over the internal packet bus to a HiPer DSP card. The HiPer DSP card decodes the packets and sends the audio over a channel in an E1 line to a Telco switch and then to the egress destination.

Traffic Flow with SS7 Enabled

The following diagram illustrates the flow of a call in the VoIP with SS7 network.

Figure 3 VoIP and SS7 (Ingress or Egress) Network Detail Diagram



Legend:
A-Link = SS7 Signaling link between an STP and SSP
SSP = Signal Switching Point (Telephone Switch)
CO = Central Office
SLAP = Signaling LAN Application Protocol
IMT = Inter-Machine Trunks (No signaling)
STP = Signal Transfer Point (SS7 Signal Routing Node)
SGP = SS7 Signaling Gateway Platform

As illustrated above starting from the right, a request for service may be initiated by an analog telephone, referred to as a POTS, or a data/FAX modem connected to a POTS line. A POTS request for service is received by a Signal Switching Point (SSP) or PSTN switch, at a telephone service provider central office. The SSP switch has SS7 signalling trunks carrying the call signalling information, (shown as 'A' links) and payload-carrying trunks carrying the voice/data call (shown as 'IMT'). The SSP (switch) uses a signalling message over an 'A' link towards the STP to signal a new call attempt. (The STP acts like a router that switches the signalling messages to the appropriate destination.)

The SSP switch receives an incoming call and selects an idle DS0 to setup the call to Total Control 1000. The signalling message from the SSP switch specifies the specific payload-carrying DS0 trunk (a member of the IMT group) that the SSP switch has reserved for the new call. The STP routes the new call signalling message to the SS7 Gateway. The signalling messages use the ISUP protocol.

The SS7 signalling Gateway (SG) translates the ISUP message to a SLAP message, and transports it over an IP network or private LAN to the appropriate Total Control 1000 that terminates the reserved IMT group member. The Total Control 1000 interprets the SLAP signalling message and associates it with the reserved IMT trunk group member (DS0). It then processes the call setup request just like it processes an ISDN PRI D-channel signalling message. The HiPer DSP performs RTP packetization. The edge server routes the RTP packets over the IP network used to transport the telephony data.

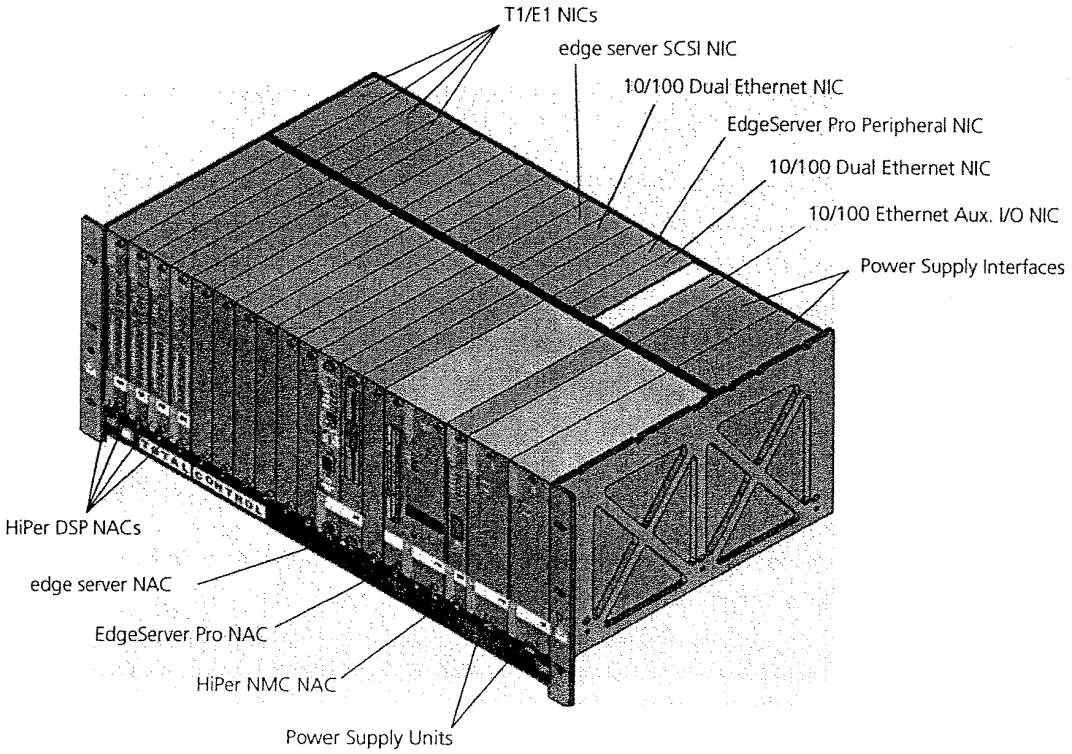
SLAP Protocol The SS7 Gateway uses the signalling LAN Application Protocol (SLAP) to link the SS7 network to the Total Control Hub. SLAP is the interface between the Total Control Chassis (VoIP Gateway) and the external SS7 Gateway system. See Figure 3. It replaces the D-channel signalling that normally exists in an ISDN PRI interface and also defines the messages to facilitate system start up, shut down, and error recovery. SLAP is CommWork's proprietary software and is supported by several signalling Gateway vendors.

CommWorks IP Telephony Media Gateway

The CommWorks IP Telephony Media Gateway is a specially equipped Total Control multiservice access unit that interconnects the public switched telephone network (PSTN) with an IP-based network.

A Media Gateway processes all voice calls in real time. It converts pulse-code modulation (PCM) data into voice-packet data, requests destination addresses, and sends signalling information to the local central offices (COs) on both ends of the call. A Media Gateway mediates between the circuit switched telephone network and the packet switched IP network.

Figure 4 Basic Media Gateway Chassis Configuration



This basic Media Gateway configuration has the following cards installed in the chassis, as shown in Figure 4:

- EdgeServer Pro NAC with a 10/100 Dual Ethernet NIC and an EdgeServer Pro Peripheral NIC
- Edge server NAC with a 10/100 Dual Ethernet NIC and an edge server SCSI NIC
- HiPer Network Management Card (HiPer NMC) NAC with a 10/100 Ethernet Auxiliary I/O NIC
- HiPer DSP NACs with HiPer DSP T1/E1 NICs
- Two 130 Amp Power Supply Units (PSUs) with Power Supply Interfaces.

For the purposes of illustration, both the edge server and the EdgeServer Pro cards are shown in this figure. Only one Gateway card set is required for the configuration shown here.

Call Models

The CommWorks IP Telephony media Gateway supports transparent trunking call models.

Transparent Trunking

Transparent trunking, or one-stage calls, are calls that have a dialed number and a prefix string. When the beginning of the dialed number string matches the prefix string, the matched portion is stripped off and the remaining string is used for Dialed Number Identification Service (DNIS)-routing.

Default CODEC for Voice Calls

The Media Gateway supports configuration of a default Media Gateway CODEC that is used for all voice calls. This parameter is set using IP Telephony Manager to configure the CommWorks Media Gateway entity. The default CODEC parameter is sent to the HiPer DSP card at the start of every call. The HiPer DSP card initializes a default CODEC type whenever a reset occurs.

The Default CODEC setting controls the call type support as defined in Table 4 below.

Table 4 CODEC Call Type Support

CODEC	Voice	FAX	Data
G.711	Yes	Yes	Yes
G.723.1	Yes	via T.38	No
G.729A	Yes	via T.38	No

Real-time Gateway Operating Statistics

The edge server card in the Media Gateway runs a Web server that provides operating statistics and event log messages in real time. You can use the Web server without disrupting call processing.

Access the Web server by using the IP address of the edge server card and any web browser that is on the same IP network as the edge server card.

Edge Server Card Sets

Unless otherwise specified, this document uses the generic term edge server to refer to either the EdgeServer Pro or the edge server.

The EdgeServer Pro card set runs the Microsoft Windows NT 4.0 Server operating system and uses two NICs for network, peripheral, and input devices. The Peripheral NIC has keyboard, video, and mouse ports for initial configuration. It also has an Ultra-wide SCSI port for additional peripheral devices such as an external CD-ROM or hard-disk drive.

The edge server card set runs the Microsoft Windows 2000 Server operating system and uses one or two NICs for network and peripheral devices. The Peripheral NIC has an Ultra-wide SCSI port for additional peripheral devices such as an external CD-ROM or hard-disk drive. Keyboard, mouse, video, and USB ports are on the front of the edge server NAC.

Both edge servers use a Dual Ethernet NIC that provides connectivity to the LAN side of the system. In a typical installation one Ethernet port is used for access to a management network; the other port is used for call access to the voice/modem/fax IP network. The edge server can be configured with two ethernet NICs for four port connectivity.

The IP telephony application that runs on the edge server sets up the call across the IP backbone, queries for IP addresses of remote (egress) Media Gateways and the SIP Proxy server, handles all call signalling, except for SS7, and initiates the creation of a Call Detail Record (CDR).

Other features include:

- H.323 and SIP support
- Auto registration (of the Media Gateway by the Gatekeeper or SIP Proxy)
- Support for in-band and out-of-band signalling
- Compliance with R2-MFC and Q.931/H.225/H.245 signalling standards
- A single edge server can be designated as both an ingress and an egress Gateway
- International Dialing Support -The CommWorks IP Telephony platform Release 2.3 supports international dialing using E.164 standards.
- Support for sending CDR's directly to the Accounting Servers when using SIP as call control mechanism.

System Capacity

One edge server card supports a different number of spans depending on the interface, the CODEC being used, and the frame size. As shown in the table below.

Table 5 Span Capacity per Media Gateway Chassis

CODEC	Frame Size	Frames per Packet	E1 Spans	T1 Spans	Voice Gateway Cards
G.711	20 (ms)	N/A	12	12	2
G.723.1 (6.3 kbps)	30 (ms)	N/A	8	8	1
G.729A	10 (ms)	1-3	12	12	2

Each Gatekeeper supports a different number of Media Gateways depending on the CODEC being used and the frame size. As shown in the table below.

Table 6 Number of Media Gateways Supported per Gatekeeper (or SIP Proxy)

Spans, Protocol	BHCA per Media Gateway	Media Gateways per Gatekeeper or SIP Proxy*
13 E1 spans, G.723.1	7800	16
12 E1 spans, G.711 (20 ms frame)	7200	17
6 E1 spans, G.711 (10 ms frame)	3600	34

The asterisks (*) indicates redundancy support.

If each Gatekeeper or SIP Proxy runs at 50% load, then it will fully support a full load from its redundant partner, if that partner goes down. Thus, while a SIP Proxy or Gatekeeper supports 250,000 BHCA, if only half of the BHCA is utilized, then you can implement a fully redundant system.

HiPer Network Management Card

The HiPer Network Management Card (HiPer NMC) provides a 10/100-Mbps Ethernet interface and manages the devices installed in the Total Control Hub under the direction of remote SNMP-based management software, such as IP Telephony Manager, CommWorks 5000, or HP OpenView.

Simple Network Management Protocol

The HiPer NMC uses the Simple Network Management Protocol (SNMP) to communicate with external management stations. The management station sends SNMP requests over IP, manipulating Management Information Bases (MIBs). The HiPer NMC carries out the requests and obtains results, and uses SNMP to return the results to the Management Station.

Network Management Card Functions

The Network Management Card (NMC) acts as an SNMP proxy for the other cards in the chassis which do not support SNMP. The NMC uses the Management Bus protocol to communicate to the installed chassis devices. The NMC provides this functionality within the chassis:

- NAC configuration management
- Automatic NAC configuration upon installation
- NAC configuration queries
- NAC software download upgrades
- Performance management
- Fault management

The NMC can also perform event management. Standard SNMP traps can be enabled to send an event notification or trap message to one or more management stations.

HiPer Network Management Card Functions

The HiPer NMC uses the Simple Network Management Protocol (SMNP) to communicate with the external management stations. The HiPer NMC acts as a SNMP Proxy for the other cards in the chassis which do not support SNMP. The Management Station sends SNMP requests over IP, manipulating Management Information Bases (MIBs). The HiPer NMC carries out the requests, obtains results and uses SNMP to return the results to the management station. Standard SNMP traps can be enabled to send an event notification or trap message to one or more management stations.

The HiPer NMC uses the Management Bus protocol to communicate to the installed chassis devices. The HiPer NMC provides this functionality within the chassis:

- NAC configuration management
- Automatic NAC configuration upon installation
- NAC configuration queries
- NAC software download upgrades
- Performance management
- Fault management
- Event management

HiPer DSP Card Set

The HiPer DSP card set consists of a T1 or E1 termination point (the T1/E1 NIC) and processing components (the HiPer DSP NAC). Each HiPer DSP terminates one T1 or E1 line. The HiPer DSP converts calls from pulse-code modulation (PCM) to digital voice packets and sends them to the edge server card set for further processing and distribution. At the far end of the call this process is reversed.

Features Include:

- G.711, G.723.1, and G.729A audio CODECs for PCM to voice/data/FAX conversion. (The default CODEC is G.711.)
- Jitter buffer to compensate for packet delay and/or lost packets.
- Q.931 ISDN D-channel signalling conversion to/from H.225 IP call control
- DTMF pass-through, H.245 compliant
- Caller ID support
- T1-PRI, E1-PRI, and E1-R2 support